

CLAIMS

1. A process for the catalytic polymerisation in the gas-phase carried out in at least two interconnected polymerisation zones, the process comprising feeding one or more monomers to said polymerisation zones in the presence of catalyst under reaction conditions and collecting the polymer product from said polymerisation zones, in which process the growing polymer particles flow upward through one of said polymerisation zones (riser) under fast fluidisation or transport conditions, leave said riser and enter another polymerisation zone (downcomer) through which they flow downward under the action of gravity, leave said downcomer and are reintroduced into the riser, thus establishing a circulation of polymer between the riser and the downcomer, the process being further characterised in that:
 - means are provided which are capable of totally or partially preventing the gas mixture present in the riser from entering the downcomer, and
 - a gas and/or liquid mixture having a composition different from the gas mixture present in the riser is introduced into the downcomer.
2. The process according to claim 1, wherein the introduction into the downcomer of the said gas and/or liquid mixture having a composition different from the gas mixture present in the riser is effective in preventing the latter mixture from entering the downcomer.
3. The process according to claim 2, wherein the introduction of the gas and/or liquid mixture of different composition into the downcomer establishes a net gas flow upward at the upper limit of the downcomer.
4. The process according to claim 2 or 3, wherein the introduction of the gas and/or liquid mixture of different composition into the downcomer is effected through one or more introduction lines placed into the downcomer.
5. The process according to claim 4, wherein said one or more introduction lines are placed at a point close to the upper limit of the volume occupied by the densified solid.
6. The process according to claim 1 or 2, wherein the gas and/or liquid mixture having a composition different from the gas mixture present in the riser is introduced into the downcomer in partially or totally liquefied form.
7. The process according to claim 6, wherein said partially or totally liquefied mixture is sprinkled over the upper surface of the bed of densified polymer particles.

8. The process according to claim 1 or 2, wherein more than one downcomers are provided, the gas mixture arriving from the riser being prevented to enter only into some of the downcomers, while in the other downcomer(s) the circulation of said gas mixture is permitted.
9. The process according to claim 8, wherein gas and/or liquid mixtures having compositions different among them and also different from the composition of the gas mixture present in the riser are fed to the different downcomers.
10. The process according to claim 6, wherein the gas-mixture circulating in the riser consists of components having different volatility and part of it is compressed and cooled to partly condense, the liquid part thus obtained being sent to the downcomer.
11. The process according to claim 10, wherein the said gas-mixture circulating in the riser contains hydrogen.
12. The process according to claim 10, wherein the said gas-mixture circulating in the riser contains ethylene, propylene and optionally an inert alkane.
13. The process according to any of claims 10 to 12, wherein the upper part of the downcomer is used as a stripping column to remove the most volatile component(s) from the liquid fed to the downcomer, the said component(s) being made to flow upwards.
14. An apparatus for the gas-phase catalytic polymerisation comprising a first vertical reactor (1), a second vertical reactor (2), the upper region of said reactor (1) being connected by a connecting part (3) to a solid gas separator (4), which is in turn connected to the upper region of said second reactor (2) the lower region of said second reactor (2) being connected to the lower region of said first reactor (1) by a connecting part (5) said solid/gas separator (4) being connected through a recycle line (6) to one or more points of reintroduction into said connecting part (5) or into said reactor (1), said apparatus having a line (12) for catalyst feeding into said reactor (1), a polymer discharge system (11) from said reactor (2), a line (13) for feeding monomers, the said apparatus being further characterised in that it comprises a line (15) for feeding gas or liquid into said reactor (2).
15. The apparatus according to claim 14, wherein the line (15) for feeding gas or liquid into said reactor (2) is placed in the upper part of said reactor (2).
16. The apparatus according to claim 13 or 14 comprising a line (18) connecting the recycle line (6) to a condenser (19), connected to the reactor (2) through the line (15) for feeding

gas or liquid into the said reactor (2) and back to line (6) through a line (20) for recycling gases.

17. The apparatus according to claim 14 or 15 comprising a line (18) connecting the recycle line (6) to a condenser (19), connected to a separating vessel (22) connected to the reactor (2) through the line (15) for feeding gas or liquid into the said reactor (2) and back to line (6) through a line (20) for recycling gases.
18. The apparatus according to claims 16 or 17, wherein the line (15) for feeding gas or liquid into the reactor (2) is equipped with an heater (24).
19. The apparatus according to claim 14, wherein the upper part (25) of the reactor (2) has a larger diameter than the rest of the reactor.
20. The apparatus according to claim 14, wherein the exit from the riser (1) is shaped as a sudden restriction.
21. The apparatus according to claim 14, wherein the section (3), connecting the riser (1) to the separator (4), has a smaller diameter than the riser (1).
22. The apparatus according to claim 14, wherein the riser (1) and the section (3) form a sharp angle.